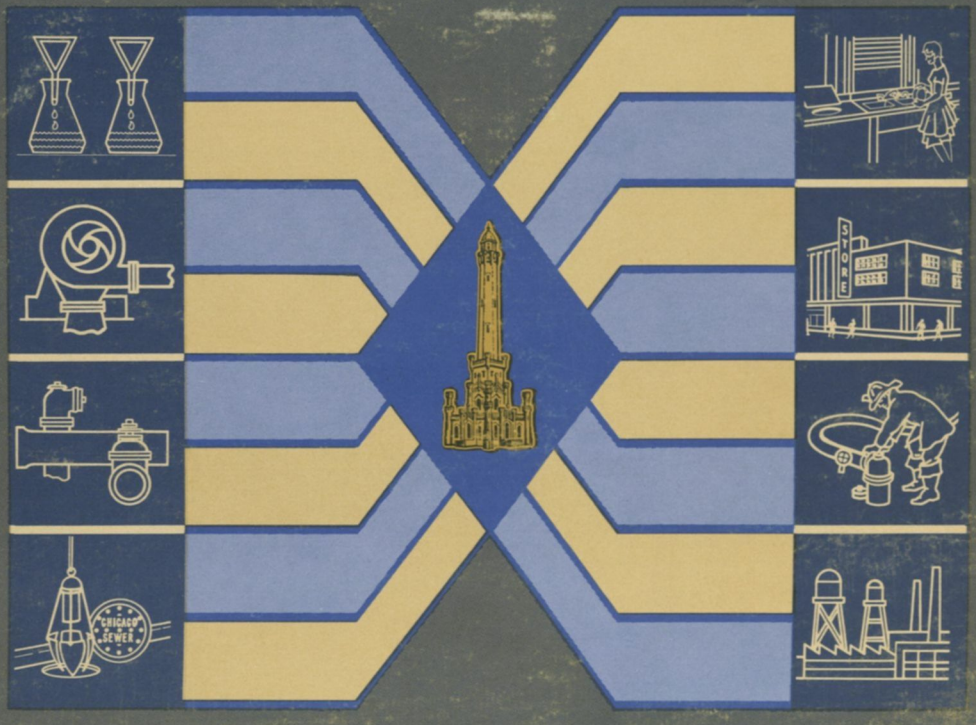
annual report 1966

department of WATER and SEWERS



CITY OF CHICAGO, RICHARD J. DALEY, MAYOR

The Honorable Richard J. Daley, Mayor
The Honorable Members of the City Council
City of Chicago, Illinois

Gentlemen:

The Department of Water and Sewers is pleased to submit this Annual Report in which we have attempted to highlight in pictorial form the important activities and accomplishments of 1966.

Responsibility for operation of the Chicago Water System rests with the Bureau of Water. The Water System currently supplies water to approximately 4,615,000 persons including the residents of Chicago and 66 suburbs. At the end of 1966, this System included four active or stand-by water intake cribs located in the Lake two to four miles from shore, the world's two largest water filtration plants, 72 miles of water supply tunnels 6 to 20 feet in diameter, ten water pumping stations, and over 4,000 miles of water m
At the present time, the Chicago Water System h
ments expected in 1980.

The Bureau of Sewers is responsible for operati
the sanitary and storm drainage within the Ci
approximately 4,036 miles of conduit ranging i
large concrete sewers, 21.5 feet wide by 19.3 feet

We are pleased to report that the Department m
throughout the year. This dependable performanc
ment staff to operate the City Water and Se
To do this we encourage changes which will all
modern technology. We believe that the effective
of the reasons Chicago has earned a reputation

Of course, the plant improvements and good
Mr. Mayor, without your guidance and leadership
wish to acknowledge the help and cooperation of
industry and most of all the public we serve. Furth
the Department of Water and Sewers for their
year's achievements possible.

CHICAGO CITY COUNCIL 1966

GORDON
City Clerk

Ward			
1. Donald W.	15. Joseph J. Krska	27. Harry L. Sain	38. William J. Cullerton
2. William H. Harvey	16. (Vacant)	28. Angelo C. Provenzano	39. Anthony C. Laurino
3. Ralph H. Metcalfe	17. Charles Chew, Jr.	29. Thomas F. Burke	40. Nathan J. Kaplan
4. Claude W. B. Holman	18. James C. Murray	30. Edwin H. McMahon	41. Edward T. Scholl
5. Leon M. Despres	19. Thomas F. Fitzpatrick	31. Thomas E. Keane	42. Mayer Goldberg
6. Robert H. Miller	20. Kenneth E. Campbell	32. Robert J. Sulski	43. Mathias Bauler
7. Nicholas J. Bohling	21. Samuel Yaksic	33. Robert Brandt	44. Thomas Rosenberg
8. James A. Condon	22. Otto F. Janousek	34. Rex Sande	45. Edwin P. Fifielski
9. Dominic J. Lupo	23. George J. Tourek	35. Casimir C. Laskowski	46. Joseph R. Kerwin
10. John J. Buchanan	24. George W. Collins	36. John F. Aiello	47. John J. Hoellen
11. Matthew J. Danaher	25. Vito Marzullo	37. Thomas J. Casey	48. Robert J. O'Rourke
12. Arthur V. Zelezinski			49. Paul T. Wigoda
13. David W. Healy			50. Jack I. Sperling

Robert F. Campbell, Record Clerk
Michael Coletta, Assistant Sergeant-at-Arms

William F. Harrah, Sergeant-at-Arms
Clement J. McDermott, Assistant Sergeant-at-Arms
Alec Busta, Assistant Sergeant-at-Arms

from LAKE TO YOU

a description of THE CHICAGO WATER SYSTEM

WATER—fresh potable water, one of the basic needs of man, was the most important of the factors considered in selecting the site for the City of Chicago. The City began with the building of Fort Dearborn in 1803. Early Settlers first drew water from the Chicago River but when it became polluted they turned to the lake shore or shallow wells. The settlers either carried water home in buckets or bought their water from peddlers in horse-drawn water wagons.

Chicago's first water system, privately owned, cost $24,000 and began operating in 1842. Lake water was pumped to an elevated wooden tank from where it flowed by gravity through wooden pipe lines under the streets. This water system soon became inadequate for the fast growing City so a new water works, municipally owned, was built and placed in operation in 1854. This new pumping station at Chicago Ave. had a steam-driven walking-beam type pump known as "Old Sally" and furnished 8 million gallons of water per day through new cast iron mains.

The old Water Tower that stands at Michigan and Chicago Avenues was erected in 1869 and withstood the Chicago Fire of 1871. Originally it housed a 138 foot high standpipe, 3 feet in diameter, that served to equalize the pressure and minimize the pulsations of the water flow in the mains. Now it has become a landmark dear to Chicagoans.

WATER SUPPLY OF EARLY CHICAGO

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er the next five years total

unted to $57,323,623.01 in
r Fund revenue items.

IBM 360 computer was in-
million water bills annually.
customer inquiries relative to

distribution system in 1966,
and South Water Filtration
isfy the above demand and

South Water Filtration Plants
treated 609 million gallons,
by the Central Plant.

water samples during the
of tests represented a sub-
measure to the increased

966, raising the total number
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the year with more than
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year raising the total miles
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levels to establish elevations

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utilities. The accident severity

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d officials from 19 foreign

ety of Professional Engineer's

Chicago's Central Water Filtration Plant, the largest water treatment plant in the world, was dedicated June 10, 1966. Above, Mayor Richard J. Daley and Commissioner James W. Jardine pause to test the plant's product. Below, at the dedication ceremony, the Mayor thanks the many men who worked so hard to build this plant.

THE OLD WATER TOWER . . . Symbol of Chicago's past, signifying the great faith of her early citizens in their City's future . . . a memorial to the victims of the Great Fire and to the indestructible will of a great City to endure.

HIGHLIGHTS

- A total of $13,744,877 was invested in capital improvements in the Water System in 1966. Programmed expenditures for capital improvements over the next five years total $52,401,000.

- The total receipts of the Water Collection Division amounted to $57,323,623.01 in 1966. Of this amount, $56,660,263.99 was collected for Water Fund revenue items.

- A modern electronic data processing system based on an IBM 360 computer was installed during the year and will process approximately 1.8 million water bills annually. Future improvements will include telescreens, to help answer customer inquiries relative to bills or payments.

- A total of 369 billion gallons of water was pumped to the distribution system in 1966, an average of 1,011 million gallons per day. The Central and South Water Filtration Plants treated 250 and 142 billion gallons respectively, to satisfy the above demand and to supply the additional water necessary for cleaning filters.

- Record demands were recorded at both the Central and South Water Filtration Plants due to extremely hot weather. On July 25, the South Plant treated 609 million gallons, while the following day, 1046 million gallons were processed by the Central Plant.

- Laboratory facilities were used to make 571,232 tests on water samples during the year, an average of more than 1,560 each day. The number of tests represented a substantial increase over that of previous years, due in large measure to the increased emphasis on pollution and water quality surveys.

- More than 21 miles of new water mains were installed in 1966, raising the total number of miles in service to more than 4,093 by the end of the year.

- Emphasis on underground leak control continued during the year with more than one-half of the total mileage of the system being monitored. A total of 1848 locations of suspected water leaks were reported. More than 90 percent of the total miles of main which were monitored were found to have negligible leakage.

- A bright orange plastic mesh net, 1000 feet long, was installed in the Lake outside of Central Water Filtration Plant intakes. It was intended to alleviate the problems associated with the annual concentrations of alewife fish, and although experimental in nature, it proved to be a sound investment and will be reinstalled in 1967.

- More than 29 miles of sewers were constructed during the year raising the total miles of sewers in service to approximately 4,036. The new sewers installed varied from 10 inches to 10 feet in diameter. In addition, 1412 new catch basins and 1,118 new manholes were added to the system.

- Bureau of Sewers survey forces ran 132 miles of precise levels to establish elevations of 213 bench monuments and 115 new street grades.

- The Department's safety record for 1966 showed an accident frequency rate of only 55 percent of the latest published national average for water utilities. The accident severity rate was only 24 percent of the national average.

- More than 25,000 persons toured the Central Water Filtration Plant in the six month period after its dedication. Guests included engineers and officials from 19 foreign countries.

- The Central Water Filtration Plant received the Illinois Society of Professional Engineer's "Outstanding Engineering Accomplishment Award" in 1966.

Do You Know?

★ **NO. 1 RATING . . .** The American Insurance Association (formerly the National Board of Fire Underwriters) has rated the Chicago Water System in Class One, which is the highest rating given by the Association. No other city over 1,000,000 population has been so classified by the Association.

★ **SELF-SUPPORTED—NO TAXES . . .** The Chicago Water System is entirely self-supporting from revenues received from the sale of water and no property or other tax monies are used to pay the operating or other costs of the system.

★ **INVESTED $225,000,000 . . .** The Chicago Water System during the last ten years has invested approximately $225,000,000 for water works capital improvements, which is approximately two and one-half times the amount invested for this purpose during the previous fifteen-year period.

★ **SERVES 4,500,000 PEOPLE . . .** The Chicago Water System provides water service to a total population of over 4,500,000 in Chicago and more than 65 adjacent suburbs in an area of over 425 square miles.

★ **A BILLION GALLONS A DAY . . .** The Chicago Water System pumps an average of over one billon gallons a day to its consumers and that a record peak hourly pumpage was established during the summer of 1966 at the rate of 2 billion 109 million gallons a day.

★ **4,080 MILES OF MAINS . . .** The Chicago Water System distributes its water through approximately 4,080 miles of water mains having pipe diameters from 6 to 60 inches.

★ **45,000 FIRE HYDRANTS . . .** The Chicago Water System has in use over 45,000 fire hydrants to aid in protecting you from fire hazards.

★ **20 NEW PUMPS . . .** During the last ten years, 20 new pumps having a total capacity of 1 billion 140 million gallons a day were installed at the Chicago pumping stations either as replacements or additions. Total installed pumping capacity now 3 billion gallons a day.

★ **WORLD'S LARGEST FILTRATION PLANTS . . .** The new Central Water Filtration Plant, by far the world's largest, has a peak capacity of 1 billion 700 million gallons per day. The South Water Filtration Plant, the second largest filtration plant in the world, has a peak capacity of 850 million gallons per day.

★ **297 MILES OF NEW MAINS . . .** During the last ten years a total of 297 miles of water distribution mains in pipe sizes from 6 to 60 inches were constructed and placed in service.

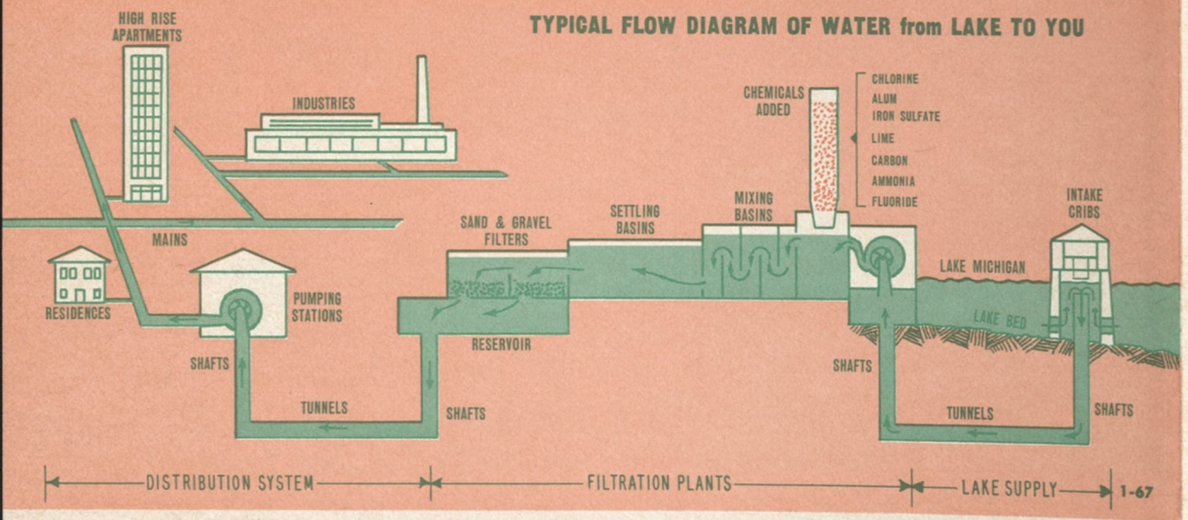
★ **74.6 MILES OF TUNNELS . . .** During the last ten years the Chicago Water System has placed into operation 10.61 miles of water tunnel, 16 feet in height and 2.85 miles of tunnel 12 feet in height.

★ **RADIOLOGICAL MONITORING . . .** The Chicago Water System continuously monitors the lake water to protect you against radioactivity hazards and was the first public water system to do so.

★ **ELECTRON MICROSCOPE . . .** The Chicago Water System's Electron Microscope has reduced emergency bacteriological test periods from 72 hours to about 18 hours in determining the presence or absence of coliform bacteria in water samples. This powerful microscope can magnify as much as 32,000 diameters—the diameter of a penny to 2,000 feet in width.

★ **FLOURIDATED WATER . . .** In May of 1956, the Chicago Water System began fluoridating the water supply and, since that time, has added fluorides to the water in the properly-controlled proportions monitored around the clock.

TYPICAL FLOW DIAGRAM OF WATER from LAKE TO YOU



DEPARTMENT OF WATER AND SEWERS • CITY OF CHICAGO • RICHARD J. DALEY, MAYOR

JAMES W. JARDINE, COMMISSIONER

370

from LAKE TO YOU

a description of THE CHICAGO WATER SYSTEM

WATER—fresh potable water, one of the basic needs of man, was the most important of the factors considered in selecting the site for the City of Chicago. The City began with the building of Fort Dearborn in 1803. Early Settlers first drew water from the Chicago River but when it became polluted they turned to the lake shore or shallow wells. The settlers either carried water home in buckets or bought their water from peddlers in horse-drawn water wagons.

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The old Water Tower that stands at Michigan and Chicago Avenues was erected in 1869 and withstood the Chicago Fire of 1871. Originally it housed a 138 foot high standpipe, 3 feet in diameter, that served to equalize the pressure and minimize the pulsations of the water flow in the mains. Now it has become a landmark dear to Chicagoans.

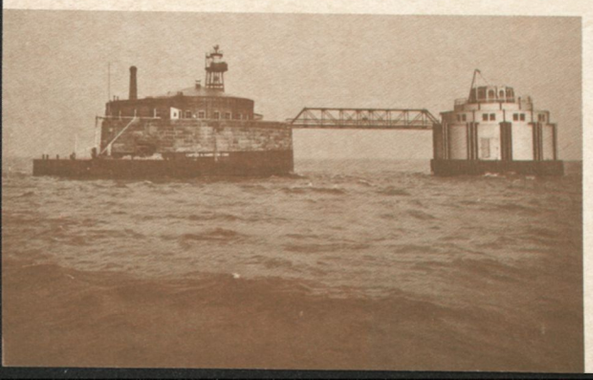
WATER SUPPLY OF EARLY CHICAGO

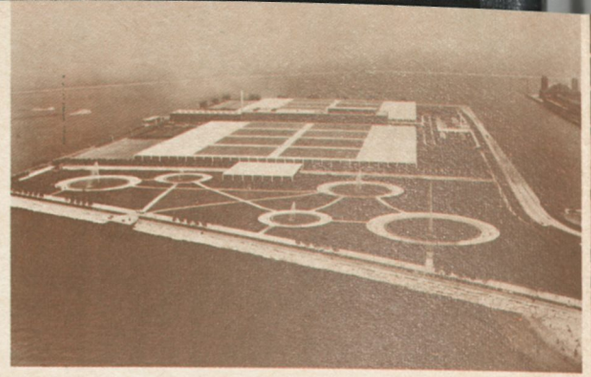
TODAY CHICAGO'S WATER SYSTEM supplies an average of more than one billion gallons of water a day throughout the year to four and one-half million people. This system supplies more than a 425 square mile area for domestic, commercial, and industrial use and for fire protection. The Chicago metropolitan area is fortunate in having its 29 mile shoreline running along one of the world's finest sources of fresh water, Lake Michigan.

The water journey begins at the intake cribs. The four intake cribs are located in the Lake, two to three miles off shore in water 32 to 35 feet deep. Cribs in service are manned around the clock, seven days a week throughout the year.

Lake water enters the crib through several ports near the bottom, then rises around the outside of the central shaft to a point where it passes through screens. It then flows down the inside of the shaft to large supply tunnels located from 50 to 200 feet below the surface of the Lake. These horseshoe and circular-shaped water tunnels vary in size from 5 to 20 feet in height and are lined with concrete for smoothness to reduce friction. In the early days the tunnels were built in clay and were brick lined, but since about 1910 they have been constructed in rock under the bed of the Lake and under the City.

The Harrison and Dever water intake cribs located 2.7 miles off shore at Chicago Avenue.





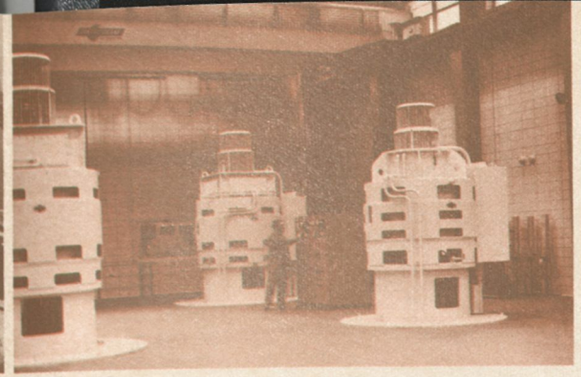
The new Central Water Filtration Plant, the world's largest, has a peak capacity of 1700 million gallons of water a day.

The water flows by gravity through the tunnels to large pumps at the filtration plants. At the filtration plants, the pumps raise the water to a height of some 20 feet above the Lake level to a point where it starts to flow by gravity through the water filtration process. It flows first through the chemical application channels, then through the coagulation and settling basins and finally through the rapid sand filters before entering the storage reservoirs. This processing at the filtration plants takes several hours.

During the processing chlorine is added to kill bacteria, aluminum sulfate (alum) and chlorinated ferrous sulfate (iron sulfate) are added to produce coagulation to precipitate and settle out impurities. Lime is added to reduce corrosion and anhydrous ammonia to eliminate chlorine tastes, activated carbon to remove other tastes and odors and flourides to prevent dental caries in children's teeth.

The safe pure water then flows by gravity from the storage reservoirs through the large underground tunnels to the pumping stations located throughout the City.

There are three pumping stations serving the north area of the City: the new Lake View Pumping Station, Thomas Jefferson and Mayfair. Four serve the central area: Chicago Avenue, Cermak, Springfield Avenue and Central Park Avenue, and four serve the south and southwest area: 68th Street, Roseland, Western Avenue and the Southwest Pumping Station which went into service in 1963.



Pump room of the Southwest Pumping Station, which was placed in operation early in 1963.

Large pumps at the pumping stations lift the water from the supply tunnels and, under 30 to 50 pounds pressure, force it through the more than 4,000 miles of water mains to homes, apartment buildings, stores, factories, and fire hydrants in the City and to more than 65 suburban communities surrounding Chicago.

The large water mains leading from the pumping stations are called feeder mains and vary in size from 24 to 60 inches in diameter. They are constructed of cast iron, prestressed concrete or steel. The feeder mains supply the water to the service mains which vary in size from 6 to 16 inches. The service mains carry it to more than one-half million service connections.

A vital use of water in any urban community is for fire fighting. Water in sufficient volume and adequate pressure is available around the clock to more than 45,000 fire hydrants located throughout the City.

Large volumes of water are used also by commerce and industry. It is an indispensable ingredient, for example, in the packing, steel and food processing industries.

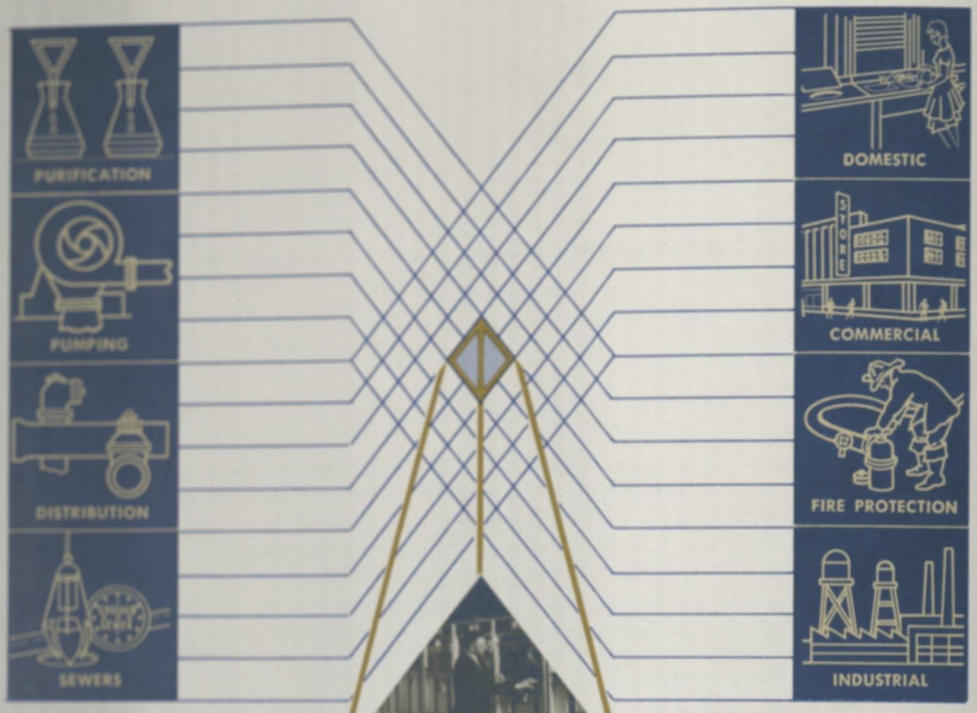
About 15% of the water pumped by the Chicago Water System goes to more than 65 suburban communities surrounding Chicago. In most instances each of these suburbs provides reservoir facilities to store water for at least a one day supply. The water is pumped from the reservoir into the distribution system in a volume and at a pressure to satisfy the demands of the community.

Thus we have seen the water moved from Lake Michigan, through the intake cribs, by tunnels to the filtration plants, through the filtration plants, then by tunnels to the pumping stations, and from the pumping stations into the complex underground network of water mains in the distribution system, finally reaching the point of usage by the individual consumer, commerce, industry, fire protection and suburbia.

Water's journey from the Lake to its final point of usage requires the constant and careful operation of a very complex and widespread utility.

PURE WATER IS PRECIOUS,
PLEASE USE IT WISELY!

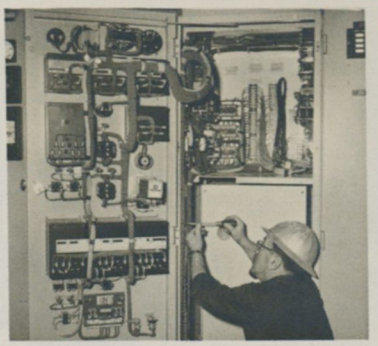
Water Distribution crew setting large valve. Chicago has more than 4,000 miles of water mains.

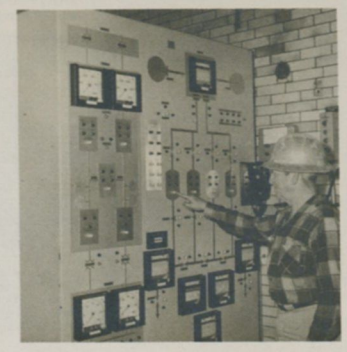


TOMORROW'S TECHNOLOGY TODAY

THE SYMBOL ABOVE REPRESENTS THE USE OF COMPUTERS IN THE PLANNING AND OPERATION OF THE VARIOUS DIVISIONS OF THE DEPARTMENT. THE DRAWINGS ON THE LEFT SIDE SHOW SOME OF THE ACTIVITIES OF THE DIVISIONS WHICH USE COMPUTERS, WHILE THE DRAWINGS ON THE RIGHT SIDE INDICATE SERVICES PROVIDED BY THE WATER SYSTEM. THE FLOW LINES BETWEEN THE SYMBOLS REPRESENT THE USE OF COMPUTERS IN COORDINATING THE ACTIVITIES OF THE DEPARTMENT TO MEET THE NEEDS OF THE CUSTOMERS. THE PHOTOGRAPHS SHOW ONE SUCH USE OF COMPUTERS. TO ANALYZE COMPLEX WATER MAIN NETWORK PROBLEMS A HIGH CAPACITY COMPUTER, LOCATED IN MINNEAPOLIS, MINNESOTA, IS USED. THE TOP PHOTOGRAPH SHOWS A PORTION OF THAT EQUIPMENT. AT THE BOTTOM, WATER DISTRIBUTION DIVISION ENGINEERS IN CHICAGO TRANSMIT THE NECESSARY DATA AND RECEIVE THE RESULTS BY WIRE FROM THE COMPUTER HUNDREDS OF MILES AWAY IN MINNEAPOLIS.

Left, control signal receiving panel at the new Lakeview Pumping Station. Center, remotely controlled switchgear at Lakeview. Right, master panel at Thomas Jefferson Station which controls and monitors Lakeview Station.





Left, analysis of proposed new method of sewer construction being made by computer. Right, extensive document preservation program by the Bureau of Sewers will prevent damage to original plans and documents.

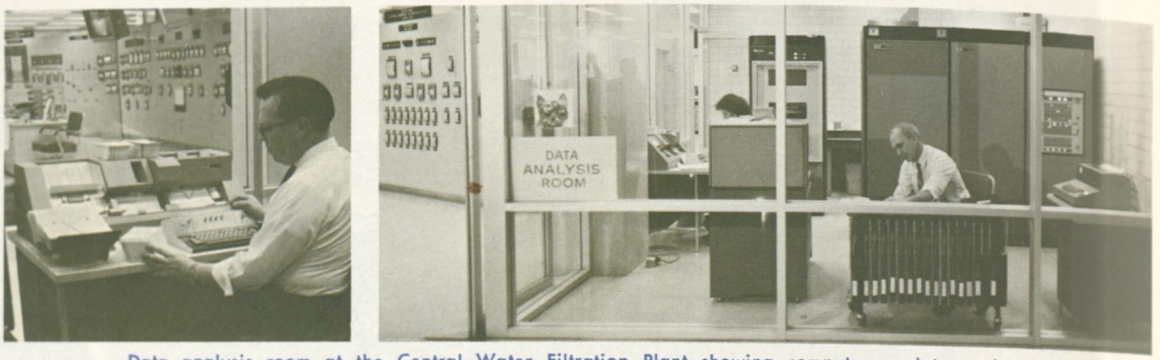
The need for an adequate supply of safe pure water has long been recognized as a determining factor in the location and development of major cities. However, even the purest water can become polluted and unsafe for drinking through carelessness or neglect, and it is therefore mandatory, that the most modern technology available be utilized to insure that water supplies remain clean and pure, and that treated water be sparkling and safe to drink. In this regard, Chicago has long been recognized as a leader. Not only are the two water filtration plants operated by Chicago the largest in the world, but also incorporate the most modern water treatment techniques known to man.

The Central Water Filtration Plant, which was placed in operation in 1964, is considered to be the most fully automated facility of its kind in the world. Chemicals are applied to the water at eight separate locations and are automatically regulated by the flow of water. From each of the highly automated chemical feed stations, signals are transmitted to the control center where more than 300 indicators are displayed on a sixty foot long panel. There, highly-trained filtration engineers, who man the center twenty-four hours every day, continually monitor and evaluate plant operations. The signals from the feed stations also enter a computer system where complex computations are made and critical data is stored for further analysis. The computer complex also monitors these signals for possible equipment malfunctions which might result in an excess or deficiency of the required chemicals, and prints out information for the engineer's guidance in making operating decisions.

After chemicals have been applied, the water passes through the remaining purification processes, throughout which the rates of flow are automatically controlled. Even backwashing the filters, which consist of cleaning by reversing the direction of the flow of water and increasing velocity by approximately eight times, is completely automated with a gallery of six filters being washed sequentially. The end result of this care and control is the water for Chicago, as potable and high in quality as the most modern techniques known to man can make it.

To complement the precautions taken throughout the treatment processes, approximately 1,500 tests of water samples are made in the laboratories each day to further insure the safety of the water reaching the consumer. These tests are made on samples collected in Lake Michigan near the water intakes and at various points within the filtration plants and distribution system. Testing facilities include a huge electron microscope which is capable of a magnification of 32,000 times and enables the highly-trained laboratory personnel to determine the presence or absence of certain bacteria in approximately one-half to one-fourth of the

The computer system installed by the Water Collection Division to process water bills and accounts. When fully operational it will be used to process all of the approximately 1.8 million bills mailed by the Division each year.



Data analysis room at the Central Water Filtration Plant showing computer used to monitor plant operation. The computer also performs complex computations and prints out pertinent information.

time required by previous conventional methods. The time element is especially important in detecting contamination in the water in emergencies such as main breaks, or disasters such as floods.

Reliability is a major consideration in the operation of a municipal water system and it must be built into both the treatment facilities and the distribution system. To insure that water is available when, where and in the quantities needed, ten pumping stations and more than four thousand miles of mains varying in size from 4 to 60 inches in diameter are in service. The distribution mains form a complex system of closed loops, so as to provide an alternate source of water supply to a given point of consumption. A computerized model of the entire distribution system has been developed as an aid in determining means of improving the system. The computer evaluates alternate means of improvement, the effects of changes in operation, and the results of increased withdrawals at various points, making all of the complex calculations very quickly.

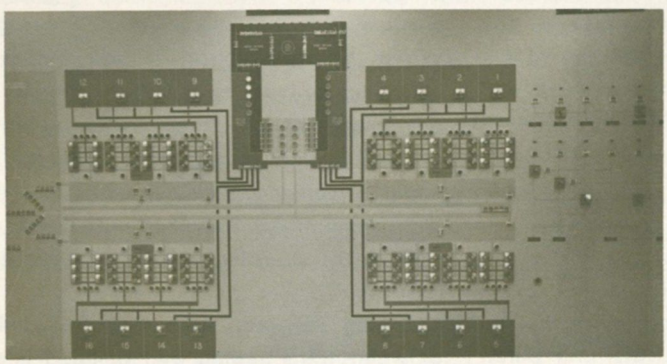
In keeping with the policy of furnishing a safe, potable water at the most reasonable cost, it is imperative that every possible means be utilized to conserve the water produced for customer use. The Department maintains both a plumbing inspection program and a program of underground leak detection. By utilizing highly developed electronic equipment, underground leaks can be located from the surface without disturbing the pavement or ground above the main. These programs, designed to find and stop water waste, are a major reason why less water is used now than in 1930, although the population receiving Chicago water has increased by 25 percent since that time.

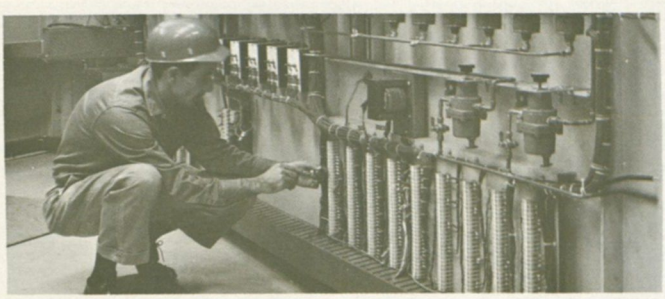
In order to improve all aspects of the service to the public, the Department has installed a computer in the Collection Division, which should by early 1967 be in use to maintain all billing records, prepare bills, and perform related functions. This IBM 360 System is leased by the Department on a shared-time basis with the Chicago Board of Health to assure its maximum utilization.

Needless to say, modern methods and equipment require that properly trained staff be available to make effective use of them. The Department continued its practice of making training available to new employees and existing personnel. Training opportunities consisted of orientation training programs, supervisory training, technical workshop and seminar sessions, on-the-job training, university extension courses and professional society meetings.

It is the combination of technical competence of employees, effective methodology and modern plant and equipment facilities, that has made Chicago's Water System a model for others, an example of the use of Tomorrow's Technology Today.

PURIFICATION





Central Water Filtration Plant Control Center. Illustration on top shows the Plant Status Board while in the center is a view of the entire control panel. Picture below shows some of the wiring and electronic devices behind the panels.

The Central and South Water Filtration Plants, the two largest water treatment plants in the world, supply treated and filtered water to the entire City of Chicago and 66 suburbs. The raw water is obtained either from shore intakes or from cribs which are located two to four miles out in the Lake. Generally the water from the cribs is of higher quality than that from the shore intakes, and the crib source usually is used more extensively at the South Plant. The Central Plant, however, uses its Shore intake exclusively and will continue to do so until the tunnel connections to the crib are completed.

Many of the principles of modern water treatment were developed by the City of Chicago and as a result the treatment processes and methods used at the Central and South Water Filtration Plants are essentially the same. Chemicals utilized in the treatment process include chlorine, to destroy harmful bacteria; activated carbon, to remove objectionable tastes and odors; aluminum sulfate and chlorinated ferrous sulfate to produce coagulation and settlement of minute inorganic particles and microscopic organisms; lime to control alkalinity and minimize pipe corrosion; anhydrous liquid ammonia, to destroy chlorinous tastes and stabilize remaining chlorine; and finally fluorides to reduce dental caries in children.

The filtration plants are designed to operate at filter rates as high as 5 gallons per square foot per minute. On a number of occasions the South Water Filtration Plant has operated at the maximum rate and produced water which was completely clear, palatable, and safe to drink. Whenever possible, all items of equipment are installed in multiple units, so that in the event of mechanical failure, standby units may be placed in immediate service. Emergency power generating equipment is also available at the filtration plants to be used to provide chlorination of lake water in case of a complete power failure.

The electron microscope, left, capable of a magnification of 32,000 times, is used to determine the presence or absence of certain bacteria in one-fourth of the time required by more conventional methods. Bacteriological laboratory facilities, right, were used to make 173,220 tests in 1966.

To assist in maintaining satisfactory control over the treatment processes for varying quantities of water, each filtration plant has a control laboratory, which is staffed twenty-four hours a day. Water samples are taken and laboratory tests made at frequent regular intervals to enable filtration engineers to determine the specific chemical treatment required.

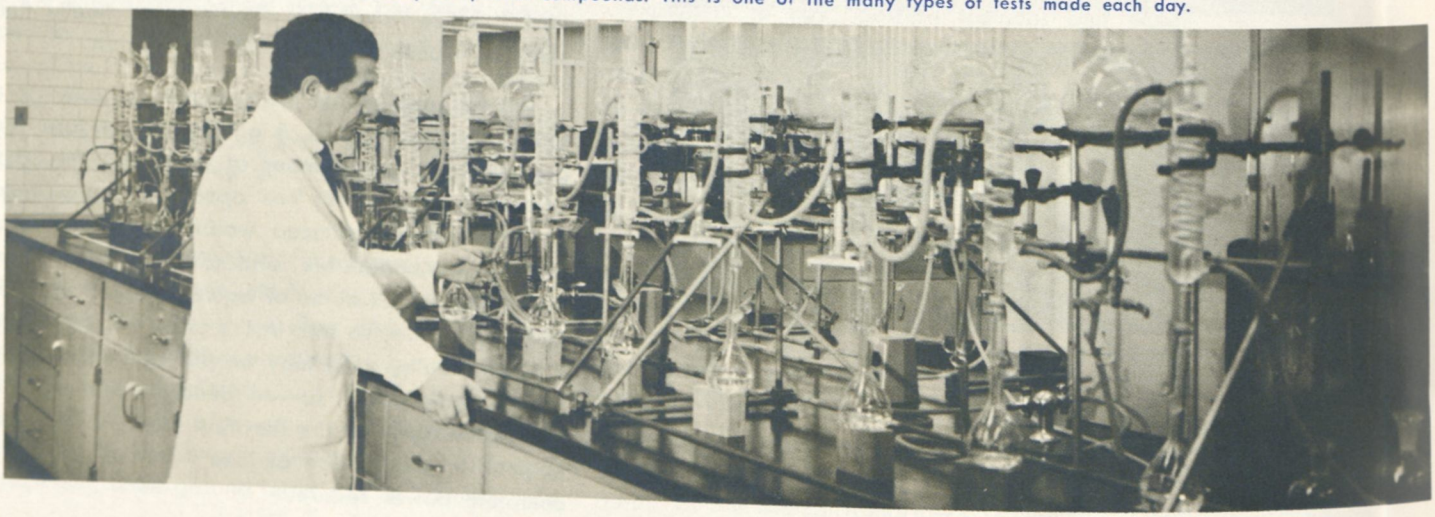
Laboratory tests are also made on water samples from Lake Michigan, the Calumet River System, intake cribs, pumping stations and the distribution system. The results yield information on the extent of pollution and water quality, and insure that the water reaching the consumers is safe and pure.

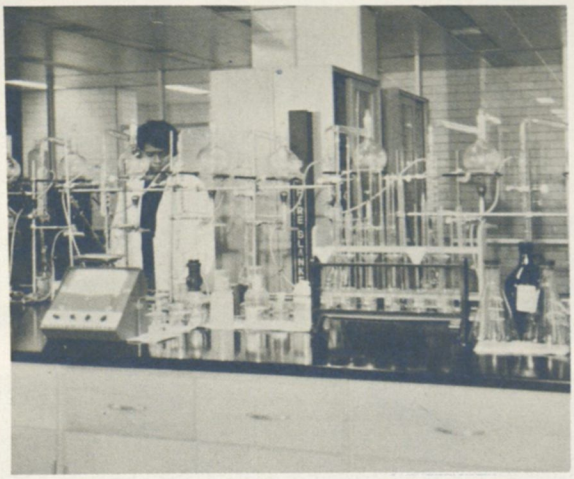
A total of 571,232 laboratory tests of water samples were made in 1966. The electron microscope was used for 4,566 examinations during the year and was particularly valuable when results were needed quickly.

In addition to the operation of the filtration plants and laboratories, the Water Purification Division provides other services to insure the delivery of safe potable water to the consumer. The Water Safety Control Section makes sure that water mains, tunnels, and shafts are sterilized properly, monitors raw water supply quality by means of pollution surveys, keeps dredging operations under surveillance, reviews plans and recommends improvements for suburban water system facilities, and makes statistical studies of field data.

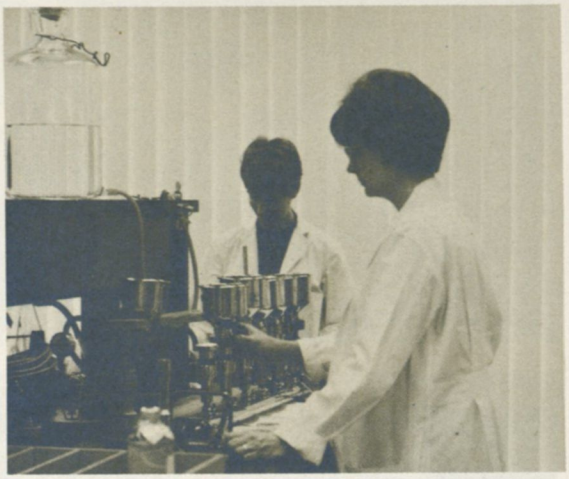
During the year more than 369 billion gallons of water were treated and pumped into the distribution system. This was an average of more than 1011 million gallons each day. A total of 42,492 tons of chemicals were used in the treatment process to insure that the final product is a consistently high quality, sparkling clear, potable water.

Tests being made in the chemical laboratory for phenol compounds. This is one of the many types of tests made each day.





Apparatus in the chemical laboratory where 53,868 tests were made in 1966.



The membrane filter method is a new procedure for the bacteriologic examination of water.

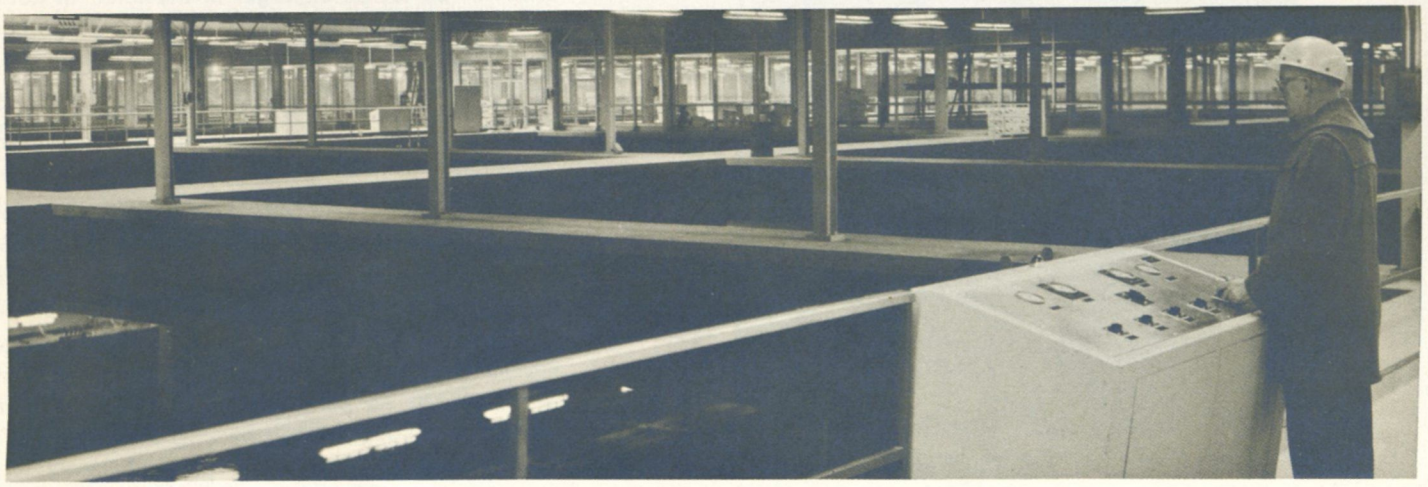
In 1966, the Central Water Filtration Plant completed its second full year of operation, although it was formally dedicated June 10, 1966. New record pumpage rates were established on July 26, when 1046 million gallons of water were pumped. The maximum hourly pumpage occurred at 2:00 P.M. on that date when the rate of 1309 million gallons per day was reached. A total of almost 250 billion gallons of water were supplied by this plant to all of Chicago north of 39th Street, and 36 suburban communities.

More than 25,000 persons toured the Central Water Filtration Plant during the six month period subsequent to its dedication in June. Engineers, technical personnel, and officials from 19 foreign countries were guided through this modern facility. Foreign visitors included representatives from such distant countries as Yemen and Nepal.

The South Water Filtration Plant also experienced unusually high demands in 1966. On July 25, 609 million gallons were pumped, establishing a new record for a twenty-four hour period. At 9:00 P.M. on that date, pumpage was at a rate of 808 million gallons per day. This was the first time in the plant's history that an hourly rate exceeded 800 million gallons per day.

During the year, considerable emphasis was placed on pollution control and water stabilization. Stabilization consists of achieving a chemical balance in treated water so that neither deposition of dissolved minerals nor pipe corrosion will occur in the distribution system. The number of pollution surveys was greatly increased during the year, and specific areas were identified where pollution might be occurring. Guidelines also were established to expedite further accomplishment in this area in 1967.

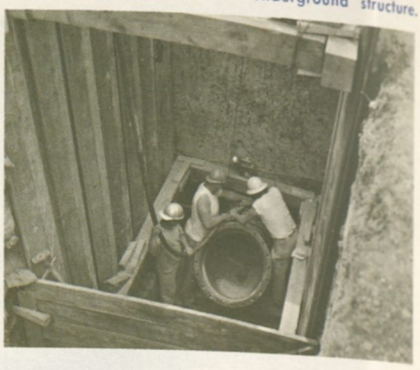
Filter control table in one of the four filter galleries at the Central Water Filtration Plant.



Engineers analyze water distribution network for future extensions with aid of computer.

Installation of a tee for a side connection on a 30-inch diameter water main.

A 30-inch diameter water main being placed beneath an underground structure.



DISTRIBUTION

Installing a 48-inch diameter water main in Wabansia Avenue.

The Chicago Water Distribution System of 1966 offers quite a contrast to the City's first system of 1842, which consisted of two miles of bored logs with internal diameters of two to six inches. The present system comprises a network of 4,093 miles of cast iron, steel, ductile iron, and concrete pipe, varying in size from 4 to 60 inches in diameter, 42,255 valves and 45,651 fire hydrants.

So as to keep pace with the changes in the demands in various areas, the distribution network is continually being analyzed to determine where revisions in and additions to the system are needed. A total of 21.73 miles of new pipe was installed in 1966, of which approximately 23 percent was 24 inches or larger in diameter. In addition, 449 new valves and 211 new fire hydrants were added during the year. The amount of main construction in 1966 represents an increase of approximately 12 percent over the amount of construction completed in 1965.

With a system containing more than 4000 miles of underground pipe, maintenance and leak control can be a major problem. However, modern technology has developed electronic equipment for detecting leakage in underground pipe. Using this method, a total of 2187.51 miles of pipe or approximately 53 percent of the entire distribution system was monitored for leaks in 1966. Although 90.6 percent of the miles of pipe monitored had

Setting a 60-inch concrete bend near the Lakeview Pumping Station.

Bolting a length of ductile iron 48-inch diameter water main to a tee for a side connection with a 24-inch diameter main.

Polyethylene tubing being placed on a new 42-inch diameter water main to prevent corrosion in bad soil conditions.

Connections and valve basins being built at Lakeview Pumping Station.

negligible or no leakage, a total of 1848 leaks were located. Including leaks detected by other means, 1991 leaks were repaired during the year.

Plumbing inspectors made 7496 first inspections during 1966; 1424 reinspections; 2664 wrecked building inspections; 16,511 building permit and service pipe inspections; 5226 meter inspections and 8698 water contamination prevention inspections all in the interests of preventing leakage and supplying a safe potable water.

Many variables must be considered to insure that continued expansion and revision of the distribution system will proceed in the most efficient manner, within the funds available for capital improvements, so that monies will be spent where they will do the most good. The physical capacities of the system, shifts in population or changes in water usage are among the principle factors that have a bearing on the ability of the system to deliver water in the quantities needed by users in every part of the City. To determine the operating characteristics of the system under various conditions computers are used extensively. In order to program these computers, a record of every feeder main 16 inches in diameter or larger is carefully maintained showing all pertinent data such as location, size, delivery capacity, length between junctions, valve locations, and flow measurement results. By thus utilizing this information, it is possible to analyze either the total system or small portions thereof under varying conditions. This is particularly useful in determining what effect a major disruption in the system would have on the ability to deliver water to the entire area served, as well as to selected segments within the total area.

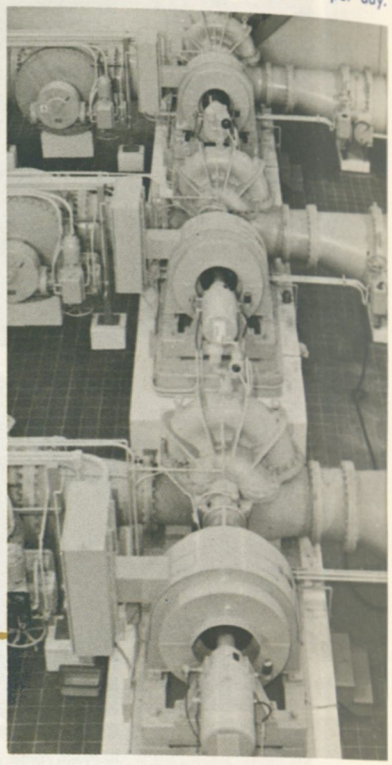
City-wide or extensive network problems are solved with the aid of a 3600 Digital Computer, the largest capacity commercial computer in the country. Studies made in 1966 included city-wide analyses under various operating conditions actually experienced during the year, an analysis assuming a city-wide electrical power failure had occurred, and analyses of operating conditions assuming certain additional facilities were in service.

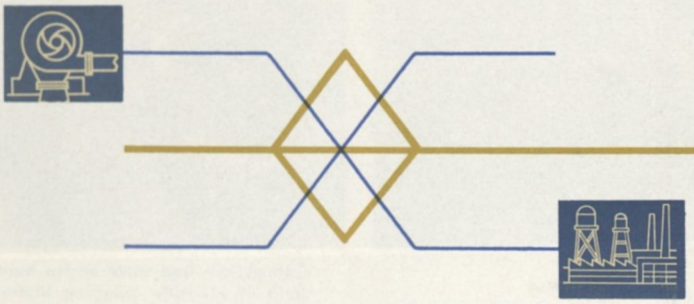
For smaller network studies, a Bendix Digital Computer has been used. Of particular importance are the analyses made on this computer to determine the influence of possible alternative improvements in a particular segment of the system. Also investigated extensively is the effect of water main repairs which may necessitate removing certain portions of the system from service. Thus, careful consideration is given not only to ability to supply water under normal operating conditions but also under unusual conditions which might occur. In contrast to the past, today these studies are a normal part of the planning process to insure that water always will be available to users in the quantity, and at the time it is needed.

Construction of a new tunnel connection to the Springfield Avenue Pumping Station.

Switch gear at the new Lakeview Pumping Station. Apparatus starts pumps when remote signal is received.

These pumps at the new Lakeview Station will raise the total installed pumping capacity of the system to 2,995 million gallons per day.





PUMPING

The Pumping Station Operation Division is responsible for the operation and maintenance of ten pumping stations, four water intake cribs and the water supply tunnels and shafts of the Chicago Water System.

During 1966, a total of 369,137 million gallons of water was pumped by the ten stations, amounting to a daily average of about 1,011 million gallons. Although this represents an increase of 20.7 million gallons per day over the amount pumped in 1965, it remains below the average of 1930, in spite of the increase in the population served from 3,683,565 in 1930 to 4,615,000 in 1966.

To maintain maximum reliability, five of the pumping stations are electric powered while pumps at the remaining five are steam driven. This provides for flexibility of operation and insures that essential water can be provided in all areas in the event of a city wide power failure or a disruption of fuel supply. Additional flexibility will be provided with the completion of the new Lakeview Pumping Station in 1967.

The Lakeview Station will be all electric powered and used primarily during peak demand periods. It will be remotely operated from the Thomas Jefferson Pumping Station, and therefore, an operating staff will not be assigned to it. The three thirty-five million gallon per day pumps will increase the total pumping capacity of the system to 2995 million gallons per day. Space for the addition of a fourth pump at a later date will also be provided at the Lakeview Station.

The capabilities of the ten pumping stations were demonstrated during the year when new records for maximum daily pumpage and maximum rate of pumpage were established. On July 25, a total of 1,599 million gallons was pumped in the twenty-four hour period. The maximum rate of 2,109 million gallons per day was reached at 4:00 P.M. on July 26. In spite of the record pumpages, prescribed pressures were maintained without danger of placing excessive strain on the facilities of any station.

Water is normally supplied to the filtration plants from the Dunne and Dever cribs, while the Four-mile and Wilson cribs are held on a stand-by basis. During 1966, however, extensive tunnel construction and revisions were in progress and the Dever crib was not used as a source of supply. The Four-mile crib was used during the summer months to furnish water to the Chicago Park District's small pumping station.

Throughout the year several construction projects were completed or underway to further improve the pumping stations and tunnels. These improvements and the completion of the new Lakeview Pumping Station will help insure the continued capability of the Chicago Water System to meet expected future increase in demands, and at the same time maintain a high level of service.

METERING

The number of water meters in service in Chicago reached a total of 161,487, of which 2,893 were installed on water services during the year.

The activities of the Division embraced both field and shop work. The staff tested a total of 17,340 meters in the shop during the year and of these 16,495 were reconditioned. In addition, 17,623 meters were repaired in the field at the site of installation.

The controlling of and the keeping of a detailed record on each water meter in service is also an important part of the work of this Division.

Revised specifications for water meters permitted procurement of magnetic type meters with sealed registers and direct reading dials in 1966. The use of meters purchased under these specifications decreased the possibility of billing mistakes resulting from erroneous meter readings.

ASSESSING, BILLING AND COLLECTING

Water Collection Division's new computer system will greatly increase efficiency and speed in the billing operations and provide instant information to the Department's staff.

During 1966, the billing and accounting system of the Water Collection Division was being converted from an electronic machine system to an IBM 360 computer system. The conversion to the new system, which should be completely operational in early 1967, will enable the Collection Division to function with greater speed and effectiveness in the billing of water charges. It will also enable management to obtain complete and timely information relative to any account, from the data stored in the memory of the computer.

On December 31, 1966, there was a total of 509,368 accounts on the books of the Water Collection Division. Water fund collections totaled $56,660,263.99 of which $44,790,930.02 were from metered-rate accounts; $11,645,476.94 from assessed-rate accounts; $57,146.86 from sewer rental accounts for properties outside the Chicago corporate limits and $166,710.17 from miscellaneous sources. An additional $663,359.02 was collected for other funds.

Field men made 1,187,164 visits to read meters, 77,146 to make assessments and resolve complaints, and 56,857 to make collections of delinquent accounts.

CITY OF CHICAGO

RICHARD J. DALEY
MAYOR

DEPARTMENT OF WATER AND SEWERS

N

1 0 1 2
SCALE IN MILES

LAKE MICHIGAN

WILSON AVE. CRIB (STAND - BY)

CARTER H. HARRISON CRIB

WM. E. DEVER CRIB

CENTRAL WATER FILTRATION PLANT

4 MILE CRIB (STAND - BY)

68TH ST. CRIB

ED. F. DUNNE CRIB

SOUTH WATER FILTRATION PLANT

MEIGS FIELD

MAYFAIR

THOMAS JEFFERSON

LAKE VIEW

SPRINGFIELD AVE.

CENTRAL PARK AVE.

CHICAGO AVE.

CERMAK

WESTERN AVE.

RESERVOIR

68TH ST.

SOUTHWEST

ROSELAND

DES PLAINES

MORTON GROVE

NILES

PARK RIDGE

LINCOLNWOOD

CHICAGO O'HARE INTERNATIONAL AIRPORT

ROSEMONT

BRYN MAWR

NORRIDGE

HARWOOD HTS.

SCHILLER PARK

IRVING PARK

FRANKLIN PARK

NORTHLAKE

STONE PARK

LEYDEN TWP.

MELROSE PARK

RIVER GROVE

FULLERTON

ELMWOOD PARK

BERKELEY

HILLSIDE

MAYWOOD

FOREST PARK

RIVER FOREST

OAK PARK

BROADVIEW

WESTCHESTER

NO. RIVERSIDE

RIVERSIDE

BERWYN

CICERO

BROOKFIELD

LA GRANGE PK.

LYONS

McCOOK

COUNTRYSIDE

HODGKINS

SUMMIT

BRIDGEVIEW

JUSTICE

WILLOW SPRINGS

SOUTH STICKNEY SANITARY DIST.

BEDFORD PARK

MIDWAY AIRPORT

OAK LAWN

CHICAGO RIDGE

HOMETOWN

EVERGREEN PARK

GARDEN HOMES SAN. DIST.

MERRIONETTE PARK

ALSIP

BLUE ISLAND

ROBBINS

CALUMET PARK

RIVERDALE

DIXMOOR

POSEN

MIDLOTHIAN

HARVEY

MARKHAM

PHOENIX

SOUTH HOLLAND

DOLTON

BURNHAM

CALUMET CITY

HAZELCREST

EAST HAZELCREST

LAKE CALUMET HARBOR

DU PAGE CO.
COOK CO.

INTAKE CRIBS—IN USE
INTAKE CRIBS—STAND-BY
WATER TUNNELS—IN USE
WATER TUNNELS—STAND-BY
FILTRATION PLANTS
PUMPING STATIONS
RESERVOIR
LARGE FEEDER MAINS—EXISTING
LARGE FEEDER MAINS—FUTURE
CITY OF CHICAGO
SUBURBAN AREAS SUPPLIED BY THE CHICAGO WATER SYSTEM
SUBURBAN AREAS PARTIALLY SUPPLIED BY THE CHICAGO WATER SYSTEM

THE CHICAGO WATER SYSTEM SERVICE AREA - 1966

DEPARTMENT OF WATER AND SEWERS

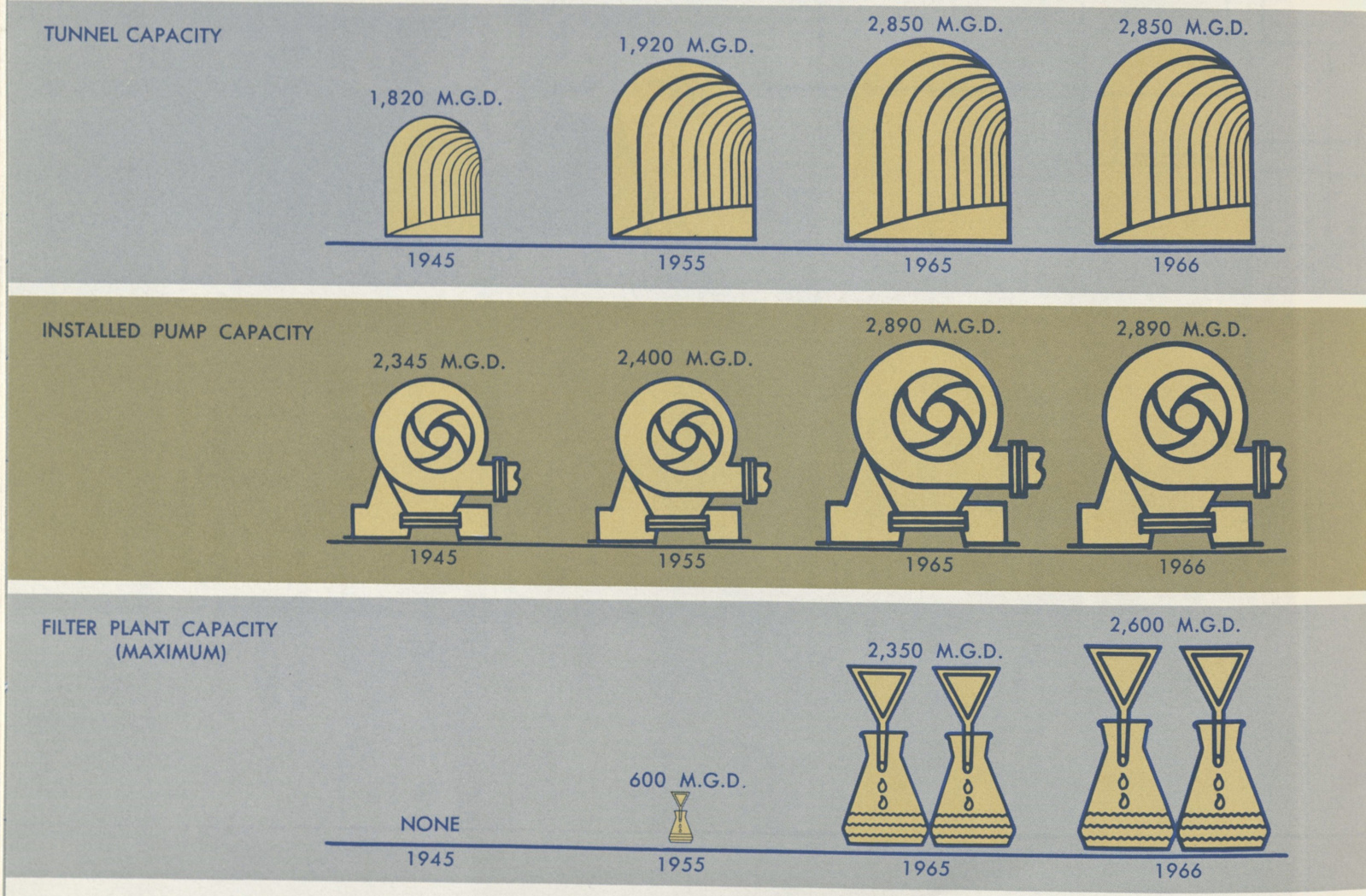
CAPITAL IMPROVEMENTS COMPLETED 1957-1966

BUREAU OF WATER:	Investment (Dollars)	Capacity Added
FILTRATION PLANTS	$102,554,327	2,000 MGD*
PUMPING STATIONS & MISC. ITEMS	29,089,767	410 MGD
WATER TUNNELS & CRIBS	30,658,666	9.2 MILES
WATER MAINS	60,970,155	279.6 MILES
TOTAL (WATER)	$223,272,915	*Million Gallons Per Day
BUREAU OF SEWERS:		
TOTAL (SEWERS)	$ 58,403,578	66.2 MILES
TOTAL (WATER & SEWERS)	$281,676,493	

CAPITAL IMPROVEMENTS PROGRAM 1967-71

BUREAU OF WATER:	Investment (Dollars)
FILTRATION PLANTS	$ 7,132,000
PUMPING STATIONS	14,995,000
WATER TUNNELS	2,352,000
FEEDER MAINS: 24" dia. & larger	11,405,000
SMALL MAINS & MISC.	14,952,000
MISCELLANEOUS	1,565,000
TOTAL (WATER)	$ 52,401,000
BUREAU OF SEWERS:	
BOND PROGRAM SEWERS	$ 81,628,000
TOTAL (WATER & SEWERS)	$134,029,000

CHICAGO WATER SYSTEM—AVAILABLE INSTALLED CAPACITIES IN MILLION GALLONS PER DAY



The Central Water Filtration Plant, the largest such facility in the world, is a result of many years of planning and study, beginning with an experimental plant built by the City about 40 years ago.

THE FUTURE

To insure that the water and sewer systems will continue to meet the needs of a growing area, it is necessary to expand and improve these facilities, to keep them geared to the demands that will be placed upon them. To accomplish this objective, the Department annually prepares a Five-Year Capital Improvements Program, designed to schedule capital expenditures in such a manner as to provide maximum benefits. This type of advance planning is a major factor in making it possible for Chicago to maintain its reputation of leadership in the fields of water supply and waste collection.

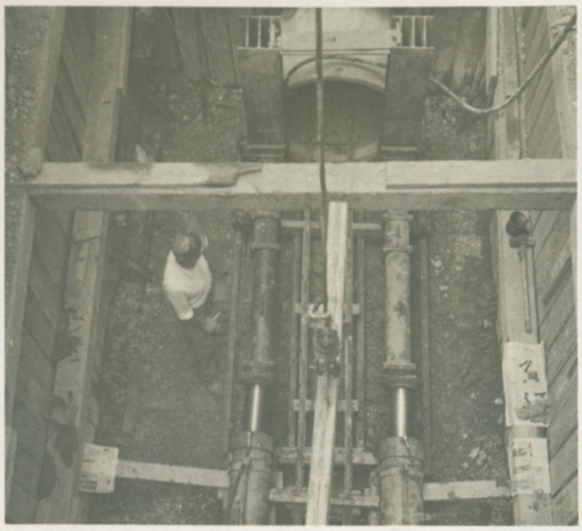
The map on pages 12 and 13, shows the service area of the Chicago Water System which in 1966 included the City of Chicago and sixty-six suburbs. This area encompasses approximately 425 square miles and contains a population of 4,615,000 people. The map also shows the location of major water facilities, including tunnels and the major distribution mains.

Following the map of the service area are three tables, which indicate the investment the City has made or will make in the Water and Sewer Systems. Table 1 is a record of capital investments made and capacity added, by type of facility, during the period of 1957 through 1966. The second table lists by type of facility, the expenditures scheduled for improvements during the five year period, 1967 through 1971. At the bottom of page 14, the increase in available installed capacities of the various facilities of the Chicago Water System is illustrated graphically.

Plans were made during 1966 to undertake a comprehensive long-range study of the Water System and the demands which may be placed upon it during the period to the year 2000. When completed, the report of findings and recommendations will serve as an instrument to be used in future expansion and improvement planning to keep the Chicago Water System ahead or, at least, abreast of the demands in the years ahead.

Plans were also being made in 1966 to demonstrate a new concept of controlling pollution resulting from storm overflow. A contract is being prepared by the Department of Public Works to construct a sewer several hundred feet below a northside street. During periods of heavy storm, the flow in excess of the capacities of present sewers will be discharged to this deep sewer where it will be stored until storm flows have subsided and the stored runoff can be pumped to the treatment plants of the Metropolitan Sanitary District of Greater Chicago for complete treatment. It is anticipated that this concept will eliminate the flooding of basements and viaducts as well as reduce storm water pollution to Chicago waterways.

In addition to the basic need of supplying potable water and providing adequate drainage, efforts will continue to modernize various components of the systems. It is anticipated that new developments in technology and continued modernization and expansion of facilities, will enable the Chicago Water and Sewerage Systems to grow with Chicago and provide the high level of services expected by the people we serve.



Concrete sewer pipe being jacked into place. This method is frequently used under railroad tracks.

Repairs being made to an old brick sewer. Four hundred main sewer breaks were repaired by the Bureau of Sewers in 1966.

SEWERS

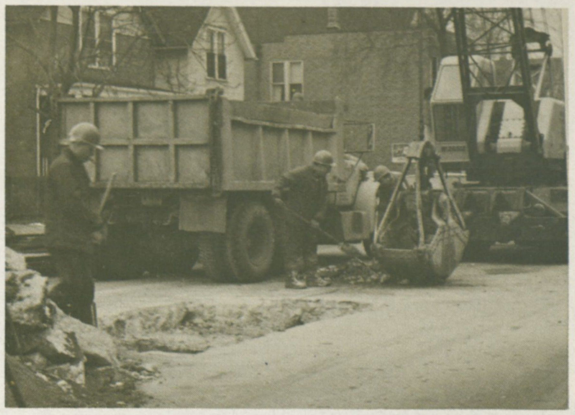
Sewer cleaning crews scraped 6,845,868 feet of sewers in 1966, an average of more than 3.5 miles per day.

Most citizens are unaware of the services they receive from the Bureau of Sewers until on a rare occasion, they find their favorite route to work barricaded for construction or repair of sewer facilities. Nevertheless, the work of the Bureau of Sewers is most essential to the health and welfare of the citizens of Chicago.

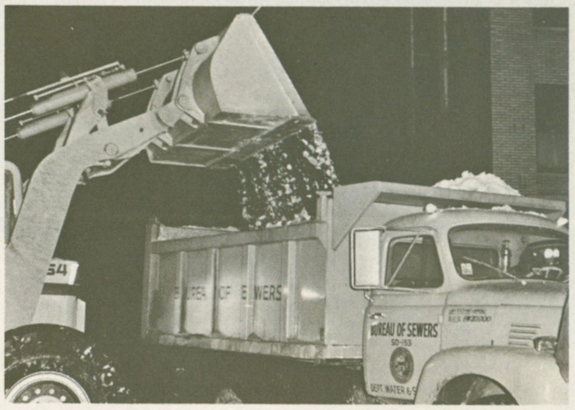
Water supply and drainage offered few problems for the early settlers of Chicago. Water was readily available from Lake Michigan and open drainage ditches served to carry storm runoff back to the Lake. However, as the city grew, these open ditches presented such a nuisance that it was necessary to replace them with wooden culverts and later with brick or tile sewers. From these early beginnings, the present Chicago Sewer System developed. Today, that system includes 4,036 miles of sewers, 144,537 manholes and 209,994 catch basins.

One of the important requisites for effective operation is the availability of up-to-date accurate records. In this connection, the Bureau maintains

Left, Bureau crews work nights under the busy streets of Chicago's Loop and, right, in daylight work in City neighborhoods.



Work begins on rebuilding of a cave-in of an old brick sewer.

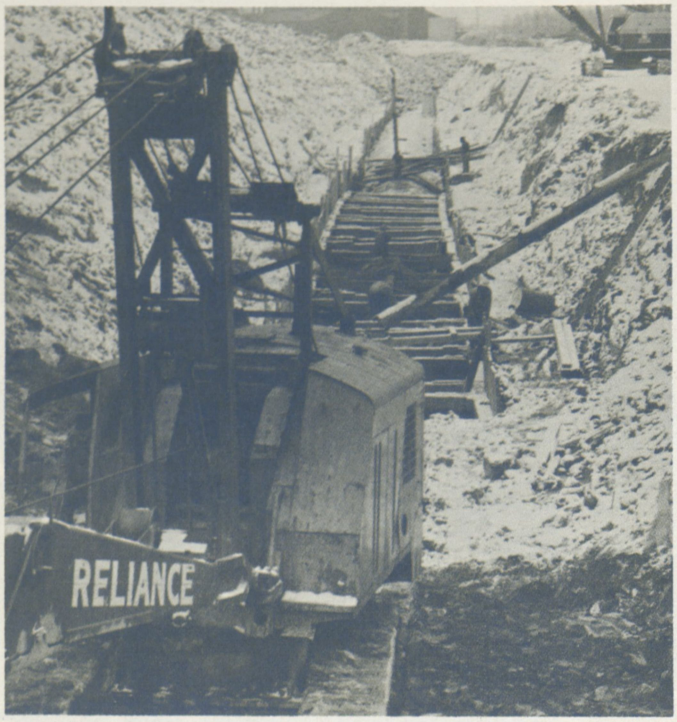


Heavy equipment aiding sewer operation after snowfall.

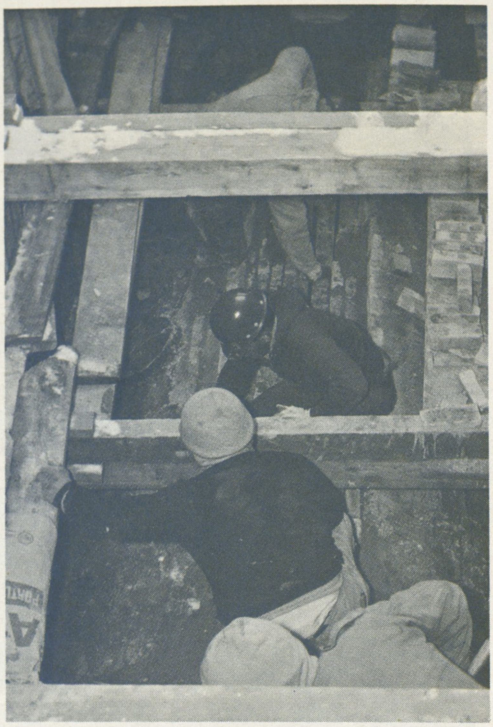
32 sewer drain atlases, 13 sewer atlases and hundreds of thousands of separate engineering and inspection drawings and reports, a complete documentation of the sewer system. Many of the original atlas records were acquired in the late nineteenth century from towns and villages that were annexed to the rapidly growing city. These records have, with occasional repair and numerous revisions, stood the test of time well, despite daily handling by citizens seeking information relative to their particular location. Since replacement of the atlas records by standard drafting methods would be a tedious task and subject to possible error, a decision was made to reproduce them photographically, a process by which original pages can be preserved and replaceable paper prints placed in the public atlases where they are subject to handling damage.

A microfilm copying machine, together with a reader-printer and a film card reproducer, was leased by the Bureau to begin an extensive program of document preservation. The new system will reduce storage space required, provide easier access to records and eliminate the possibility of document damage. This program has also enabled the Bureau to copy books containing individual house drain as built sketches, which are irreplaceable and inconvenient to reproduce.

Field forces responsible for the repair, maintenance and construction activities of the Department, have also adopted the methods afforded by a growing technology. Completed installation of a mobile radio communication system has greatly enhanced the control and direction of crews and equipment in the field. Two-way radios have been installed in twenty-eight pieces of mobile equipment and in the vehicles of key supervisory personnel. This radio control system plays an important role in handling emergencies such as a major main sewer break or a fire when the Chicago Fire Department may need special assistance in keeping the bordering streets clear of water and/or ice and in preventing the flooding of nearby properties.



Eggleston Ave. at 127th St. — construction of a large open-cut sewer proceeds during the winter.



Bricklayers rebuilding the arch of a brick sewer in tight quarters.

SEWERS

New repair and construction equipment purchased included dump and pickup trucks, a variety of high capacity pumps, sewer scraping machines, power rodders, eductors, truck mounted hoists with clam shell buckets, and water flushers.

The Bureau's personnel included a staff of inspectors who were on duty during the year to see that the installation of all new sewers connected to the city system, met city specifications. Mason inspectors assigned to construction projects, both public and private, supervised the construction of 29.43 miles of sewer varying in size from ten inches to ten feet in diameter, and of 1,565 new catch basins and 1,118 new manholes. Cleaning and repair crews performed a variety of services during the year, including scraping 6,845,868 feet of sewer, cleaning 290,441 catch basins, and repairing 400 main sewer breaks, 7862 catch basins and 2668 manholes.

The Bureau also maintains a system of bench monuments, which are points of known elevation used by architects, engineers and surveyors to establish correct elevations for new buildings, highways, sewers and other public and private structures. These monuments consist of a cylindrical column of concrete, eight feet long and fifteen inches in diameter, buried in the ground and supporting a stainless steel pin, the elevation of which is precisely established. For this work during 1966, the Bureau of Sewer forces constructed twenty-six new monuments and ran 132 miles of precise levels necessary to establish the elevation of 213 monuments and 115 new street grades.

In addition to the normal operations of the sewer system, the Bureau of Sewers is constantly seeking new methods of solving hydraulic problems and other problems concerning the need for addition to or revision of the sewer system. Computers are used to evaluate the operation of various portions of the sewer system to determine flow characteristics and point up the areas where additional capacity may be needed.

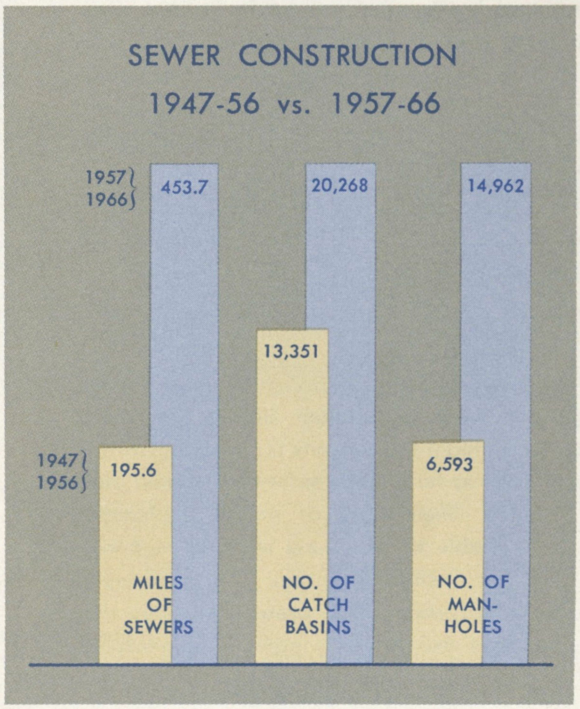
Catch basins are cleaned by a special clam shovel device called an "orange peel." 290,441 catch basins were cleaned during the year.

Bureau crew wields a large power rodding machine.

Engineers check elevation to maintain proper grade.

Left, engineer descends by rope ladder from a manhole on a cold day into a vapor filled sewer to, right, inspect conditions at an industrial service connection.

Early in 1967, construction should begin on the new Lawrence Avenue Underflow Sewer System, which will be a relief sewer located in bedrock several hundred feet below the ground surface. During normal periods, flow will be handled by existing sewers and discharged into the interceptors of the Metropolitan Sanitary District of Greater Chicago for treatment. However, during periods of heavy storm, when the capacity of the existing sewers are reached, excess runoff will be discharged into the proposed deeper system rather than into the interceptors or waterways. This will permit storage of substantial quantities of storm water and sanitary drainage until such time as the treatment plants of the Sanitary District are below maximum capacity and are well able to handle the stored drainage. By computer analysis it has been determined that the Biochemical Oxygen Demand reaching the waterways in a typical year without complete treatment will be reduced by 72 percent in the area served by this proposed new holding system.



Bureau of Sewers employees illustrate the use of safety equipment to prevent injury. Left, checking for dangerous gases before entering a manhole.

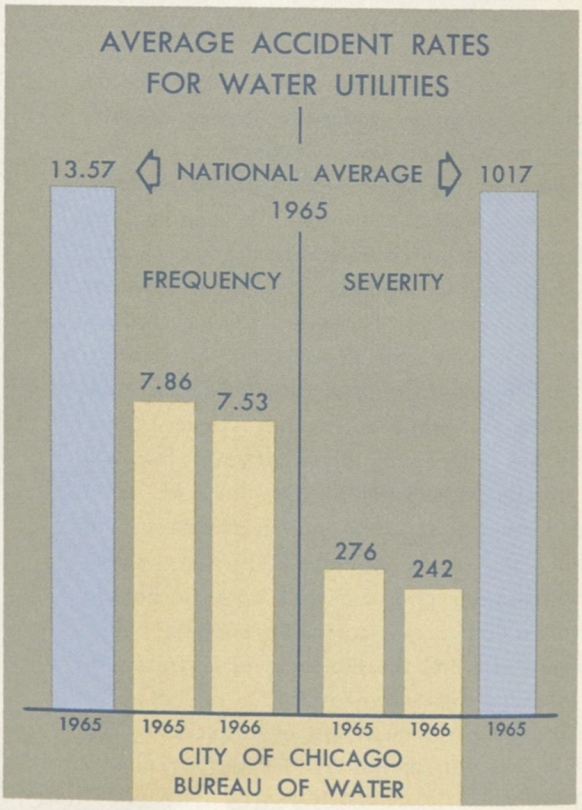
SAFETY

The Department of Water and Sewers continued the intensive promotion of its comprehensive safety program with good results during 1966, as indicated by a comparison of the Department's accident frequency and severity rates with the national averages for these rates. The 1966 Annual Accident Data Report shows that the frequency rate for the Bureau of Water was 7.53, which amounted to only 55.4 percent of the latest published national average for water utilities. The severity rate was 242 or 24 percent of the national average.

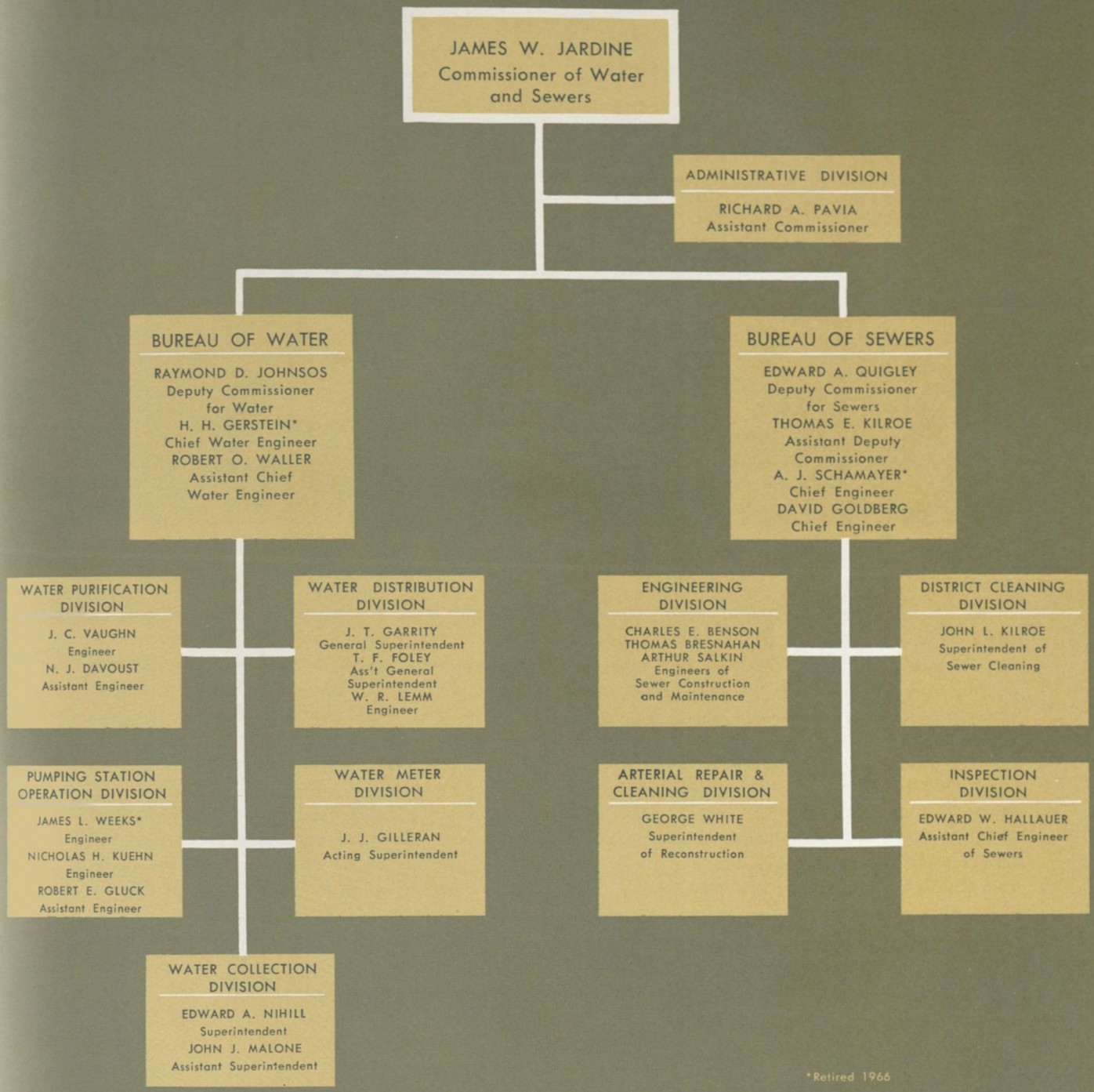
A Safety Committee, composed of the safety director and representatives of the various operating divisions of the Department, met regularly throughout the year to discuss safety practices and policies. In addition, safety committees at lower organizational levels were formed in various divisions to bring greater emphasis to the safety program closer to the actual work activities. The policy of reporting accidents was strictly enforced to insure that all accidents were accurately reported, recorded and analyzed to determine if recurrences could be prevented. Safety bulletins, containing suggestions for avoiding accidents at home, at work and on vacation were sent periodically to all employees of the Department and additional monthly "Safetygrams" were displayed conspicuously on bulletin boards.

Campaigns were undertaken during the year, designed to spotlight the reasons for wearing safety equipment such as hard hats, safety toe shoes, and safety goggles. Such items of safety equipment are made available to personnel working in areas where they are needed and their use is strongly encouraged. In certain other areas, however, the use of hard hats and safety goggles is mandatory.

Although considerable effort is required to implement the safety program, the decrease in time lost due to accidents and increased overall efficiency, not to mention the significant reduction in human pain, has more than compensated for the effort expended.



DEPARTMENT OF WATER AND SEWERS



*Retired 1966

ADMINISTRATION AND FUNCTIONS

The Commissioner of Water and Sewers is the chief executive officer of the Department. Each of the two component Bureaus, the Bureau of Water and the Bureau of Sewers, is headed by a Deputy Commissioner.

The Bureau of Water is responsible for the operation and maintenance of the Chicago Water System which furnishes a good quality, filtered water to all of Chicago and 66 suburbs. The Bureau is composed of five Divisions: (1) the Purification Division which operates and maintains the two largest water treatment plants in the world and monitors the water supply to insure its potability; (2) the Pumping Station Operation Division which operates and maintains four water intake cribs and ten pumping stations; (3) the Water Distribution Division which operates and maintains the water distribution system and constructs additional water mains as needed; (4) the Meter Division which operates the meter repair shop, installs large meters, inspects and makes repairs of meters in the field and maintains complete records on all meters, and (5) the Collection Division which reads meters in service and bills, collects and accounts for water charges.

The Bureau of Sewers operates and maintains the Chicago Public Sewer System which collects and transports sanitary and industrial wastes and surface water drainage to the interceptor sewers of the Metropolitan Sanitary District of Greater Chicago. The Bureau is composed of five Divisions: (1) the Engineering Division which plans and designs sewer extensions, betterments and major repairs; (2) the Cleaning Division which scrapes and flushes sewers and cleans catch basins on a district basis; (3) the Repair Division which makes repairs to the Sewer System on a district basis; (4) the Motor Fuel Tax Division which cleans and repairs City arterial highway sewers, and (5) the Inspection Division which supervises sewer construction, the installation of connections and the underground work of others done near public sewers to protect the sewers from damage.

FINANCIAL STATEMENTS*—WATER WORKS FUNDS
BALANCE SHEET
December 31, 1966

ASSETS

Fixed Assets:	
Real Estate	$ 1,983,234
Structures and Equipment	473,789,919
Less Reserve for Depreciation	77,831,437
Net Structures and Equipment	$397,941,716
Work in Progress	18,000,668
Total Fixed Assets	$415,942,384
Net Assets in Working Capital Funds	$ 7,651,611
Cash for Repayment of Water Pipe Extension Certificates	$ 391,123
Long Term Accounts Receivable	$ 428,503
Current Assets:	
Cash with City Treasurer, Revenue Fund	$ 7,722,888
Cash with City Treasurer, Certificates Fund	21,000,438
Petty Cash	18,150
Water Accounts Receivable	3,770,329
Other Accounts Receivable	67,849
Due from Other Funds	607,396
Inventories	1,185,807
Total Assets	$458,786,478

LIABILITIES AND CITY EQUITY

City of Chicago Equity	$274,699,986
Long Term Liabilities:	
Certificates of Indebtedness	$176,000,000
Advances in Aid of Construction	137,929
Water Pipe Extension Certificates	227,436
Total Long Term Liabilities	$176,365,365
Current Liabilities:	
Vouchers Payable from Revenue Fund	$ 4,324,783
Vouchers Payable from Certificates Fund	2,139,462
Accrued Interest Payable on Long Term Debt	1,183,750
Other Current Liabilities	73,132
Total Current Liabilities	$ 7,721,127
Total Liabilities and City Equity	$458,786,478

*These statements represent a preliminary financial summary of the water funds and are not final. Final statements will be included in the City Comptroller's Report for 1966.

FINANCE

The Chicago Water System is a self supporting utility deriving monies for all operating expenses, maintenance costs, debt retirement and other expenses from the revenues received from water charges. It does not receive any monies from property or other tax levies.

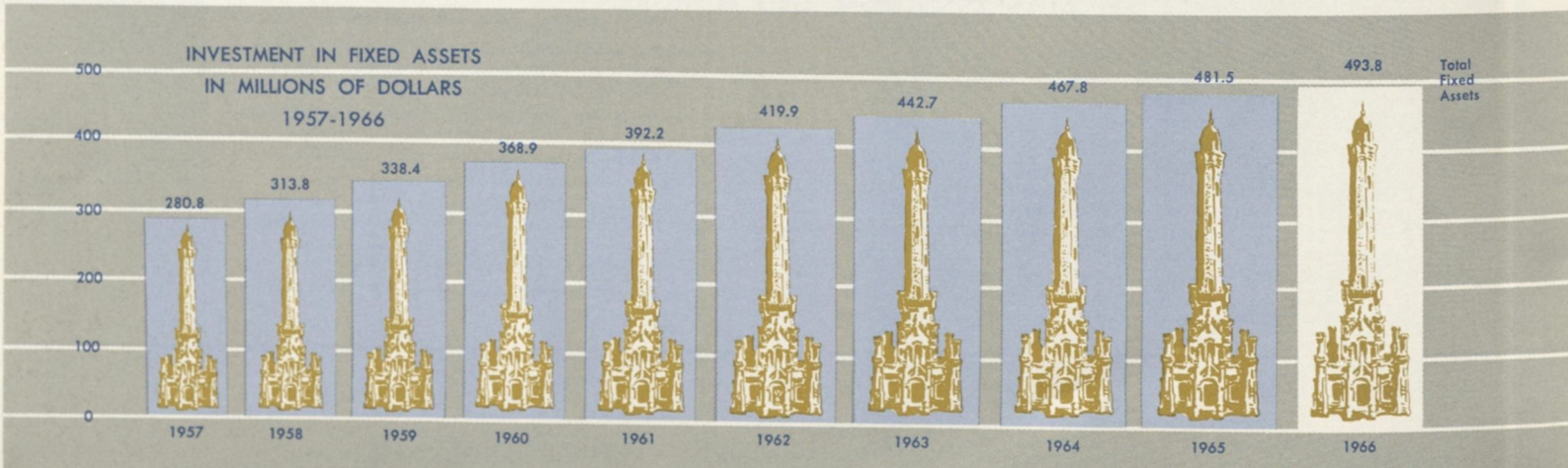
An analysis of the water fund cash flow for 1966 shows that total cash receipts were $58,030,013, while operating and maintenance costs of the water system amounted to $38,473,365 and debt service costs were $12,519,375 including interests and principal payments on certificates of indebtedness. The remainder or $7,037,273 was available for capital improvement construction. The debt coverage ratio amounted to 1.56.

During the year of 1966, the total investment in fixed assets increased from 481.5 million dollars to 493.8 million dollars; a net gain of 12.3 million dollars.

CAPITAL IMPROVEMENTS — 1966

During 1966, a total of $13,744,877 was invested in the Water System for the improvement and expansion of plants and facilities. Of this amount, $7,037,273 came from current revenues. Included in the Capital Improvements Program were expenditures of $4,528,403 for improvement of filtration plant facilities, $6,273,000 for the construction of new water mains, $62,554 for improvement of water tunnels and cribs, $531,000 for the purchase of new equipment, and $2,349,920 for the construction of improvements in the pumping stations, including the construction of the new remotely controlled Lakeview Station.

The preliminary Five-Year Capital Improvements Program for the Chicago Water System, which covers a period from 1967 to 1971, calls for the investment of $52,401,000. This includes $2,352,000 for tunnels and shafts; $7,132,000 for filtration plant improvements; $14,995,000 for pumping stations and $27,922,000 for water main construction.

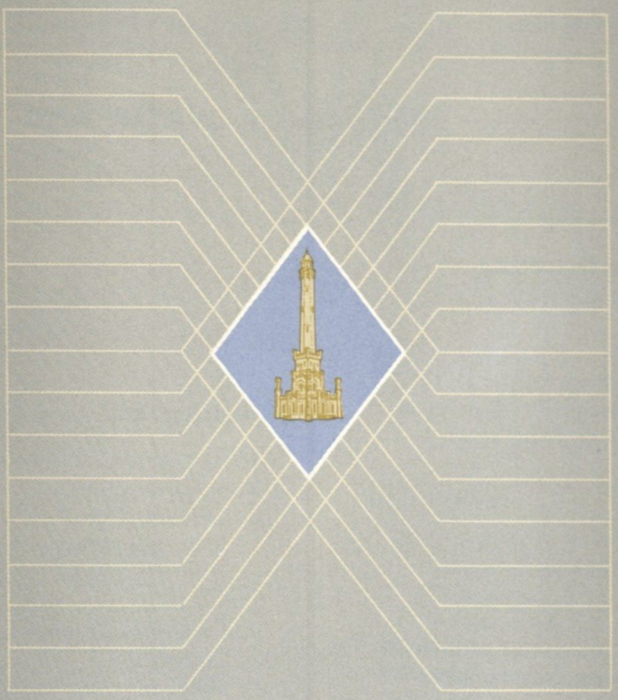


SOURCE AND USE OF 1966 WATER REVENUE FUNDS

CASH RECEIVED FROM:

LARGE COMMERCIAL CONSUMERS	24.9%
LARGE INDUSTRIAL CONSUMERS	16.8%
SMALL CONSUMERS	15.8%
SUBURBAN CONSUMERS	19.9%
RESIDENTIAL (ASSESSED RATES)	19.9%
ALL OTHER	2.7%
TOTAL	100.0%

$ 58,030,013



CASH DEDICATED TO:

PURIFICATION	14.9%
PUMPING	12.5%
DISTRIBUTION	21.3%
ACCOUNTING & COLLECTING	5.0%
OTHER	12.6%
*OPERATING COSTS	66.3%

$ 38,473,365

*ADMINISTRATIVE COSTS PRO-RATED TO DIRECT COSTS

RETIREMENT OF LONG TERM DEBT	10.3%
INTEREST	11.3%
DEBT SERVICE	21.6%

$ 12,519,375

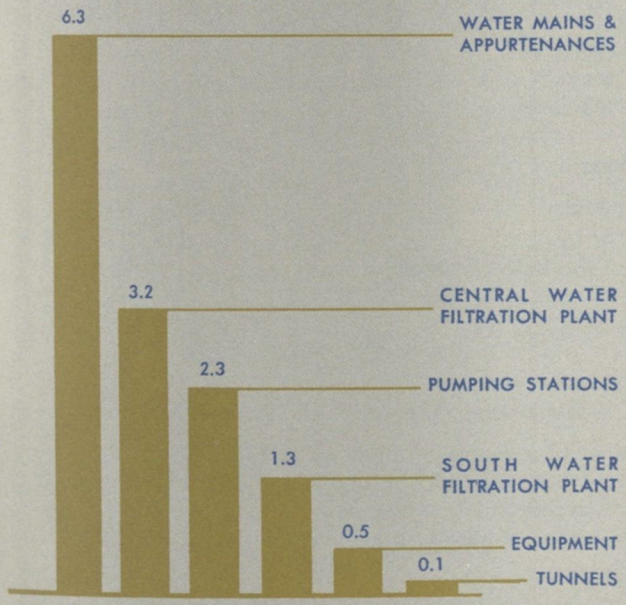
CASH USED IN CAPITAL IMPROVEMENTS	12.1%

$ 7,037,273

TOTAL	100.0%

$ 58,030,013

CAPITAL IMPROVEMENTS—1966
IN MILLIONS OF DOLLARS



INCOME STATEMENT
Year Ended December 31, 1966

Operating Revenues:		
Sales of Water		$ 57,276,844
Other Operating Revenues		754,874
Operations of Working Capital Funds		(450,000)
Total Operating Revenues		$ 57,581,718
Operating Expenses Excluding Depreciation:		
Source of Supply	$ 356,749	
Power and Plumbing	6,378,960	
Purification	8,525,803	
Transmission and Distribution	11,747,916	
Maintenance	6,858,036	
Customer Accounting and Collecting	2,543,124	
Administration and General	2,826,177	
Total		39,236,765
Operating Income Before Depreciation		$ 18,344,953
Add Non-Operating Income:		
Interest Earned	$ 1,247,674	
Rental of Real Estate	43,326	
Other	3,764	
Total Non-Operating Income		1,284,764
Sub-Total		$ 19,639,717
Less Non-Operating Expense:		
Interest on Water Certificates	$ 6,485,677	
Less Interest Charged to Construction	533,642	
Net Interest Expense	$ 5,952,035	
Other	36,986	
Total Non-Operating Expense		5,989,021
Net Income before Depreciation		$ 13,650,696
Depreciation Expense		7,171,357
Net Income Carried to City Equity		$ 6,479,339

STATEMENT OF CHANGE IN CITY EQUITY
Year Ended December 31, 1966

City Equity January 1	$268,543,712
Add Net Income	6,479,339
Deduct Surplus Adjustment	(323,065)
City Equity December 31	$274,699,986

1966 MAJOR WATER AND SEWER STATISTICS

SEWERS

Existing Sewer System:

Miles of Sewer	4,036.74
Catch Basins	209,994
Manholes	144,537

1966 New Sewer Construction:

Miles of Sewers—all sizes	29.43
Catch Basins	1,412
Manholes	1,118

Inspections	192,889
Complaints Handled	20,428

Repairs:

Total Number of Sewer System Repair Jobs	11,467
Main Sewer Breaks	400
Catch Basins	7,862
Manholes	2,668
Gutter Grates and Basin Outlets	537

Cleaning:

Sewers Scraped—Feet	6,845,868
Catch Basins Cleaned	290,441

Street Grades Established and Approved by City Council	115
Standard Bench Monuments and Ordinary Benches Established	213
Standard Bench Monuments Constructed	26

Receipts:

House Drain Permit Fees	$ 120,345
Other Permit Fees	64,415
Special Deposits	104,220
Out-of-Town Connection Fees	57,147
Drain Layers' License Fees	39,150
Total Receipts	$ 385,277

WATER

Population and Area Served

(Based on Reliable estimates)

Population supplied:

Chicago (1960 U.S. Census 3,550,404)	3,551,000
Suburban (Year-end census as revised)	1,064,000
Total	4,615,000

Area served (in square miles):

Chicago	227
Sixty-six suburbs	198
Total	425

Per Capita Consumption

	Gallons Per Day
Chicago	243
Suburban	140
Average	219

Chemical and Physical Qualities of Water

Total hardness (as parts per million Calcium Carbonate)	135
Water temperatures: Intake (Dever Crib)	
Average	52.1°F.
Maximum	76.0°F.
Minimum	33.0°F.

Pumpage

Annual

	Gallons
Chicago	314,955,000,000
Suburban communities and industries (metered)	54,182,000,000
Total*	369,137,000,000

*(Amount through Western Ave. Reservoir 1,196,990,000)

Annual Metered Consumption in Chicago (51.8% † of Chicago pumpage) 163,124,000,000

†Percentage of Revenue from Metered rates: 79.6%

Daily

Total daily average	1,011,330,000
Maximum day, July 25	1,599,430,000
Maximum hour (rate) July 26, 4:00 P.M.	2,109,000,000
Daily Average—Chicago	862,890,000
Daily Average—Suburban	148,440,000

WATER

Purity Control

Laboratory tests made:	
Bacteriological Laboratory	173,220
Microscopically for plankton	8,704
Chemical Laboratory	53,868
Electron Microscope	4,566
Control Laboratory S.W.F.P.	136,739
Control Laboratory C.W.F.P.	194,135
Total tests made	571,232

Bacteriological Results

Annual average coliform organisms per 100 ml*

	South District	North & Central District
Raw	36.1	270.**
Plant outlet	0.0005	0.0015
Pumping stations	0.00	0.00
Distribution system	0.03	0.10

*U. S. Public Health Service Standard for safe drinking water permits a maximum average of 1.0 coliform organisms per 100 ml

**Shore water only

Purification Treatment

	Gallons
Complete Filtration Treatment	391,682,000,000

Chemicals Applied—Tons

	Filtration Treatment		
	SWFP	CWFP	Pumping Stations
Chlorine	1759	2633	251*
Aluminum Sulfate (17% Al_2O_3)	5412	8704	——
Activated Carbon	2339	2435	——
Lime	3648	8850	——
Ferrous Sulfate (as $FeSO_4$)	2811	2353	——
Anhydrous Ammonia	147	——	——
Sodium Silicate	40	——	——
Hydrofluosilicic Acid (23%)	2645	4220	——
(As Fluorine)	481	820	——

*Supplemental chlorination applied at the six pumping stations in the North and Central Districts.

Supply

Crib intakes in service	2
Crib intakes on stand-by service	2
Shore intakes	2
Miles of water supply tunnels under lake and land (6 to 20 feet in diameter)	72.3

Pumping

Pumping stations	10
Pumps available for service	50
Installed pumping capacity (Million gallons per day)	2890

Annual Pumpage

	Million Gallons
By electrically driven pumps	151,925
By steam driven pumps	217,212
Total annual pumpage.	369,137
Coal used by steam powered pumps (tons)	124,016
Electric power used by electrically powered pumps (kilowatt hrs.)	75,990,000

Distribution

Water Mains: (in miles)	
In use—December 31, 1966	4,093.08
Extended	21.73
Abandoned	11.66
Net addition to system	10.07
Diameter of pipe (inches)	4 to 60
Fire Hydrants:	
In use—December 31, 1966	45,651
Installed	211
Abandoned	89
Net Increase	122
Gate Valves:	
In use—December 31, 1966	42,255
Installed	449
Abandoned	234
Net Increase	215
Pressure range in mains (lbs. per square inch)	28 to 58
Average pressure at curb (lbs. per square inch)	36
Miles of pipe tested for underground leakage	2,187.51
Premises inspected—house to house leakage survey	52,145
Repaired main breaks—4 inch to 36 inch in diameter	309

Meters

In service—December 31, 1966	161,487
Installed by Master Plumbers	1,348
Installed by Water Distribution Division	1,545
Total	2,893
Removed	2,747
Net Increase	146
Repaired on premises	17,623
Repaired in shops	16,495
Tested	17,340
Non-metered (assessed rate) services	347,881
Total Services (assessed & metered)	509,368

Supplements covering complete 1966 water or sewer statistics are available upon request.

'66

DEPARTMENT OF WATER AND SEWERS — CITY OF CHICAGO

ANNUAL REPORT